



■ DC Characteristics

Accuracy Specifications ± (% of reading + % of range) [1]

Function	Range [3]	Test Current or Burden Voltage	24 Hour [2] 23°C ± 1°C	90 Day 23°C ± 5°C	1 Year 23°C ± 5°C	Temperature Coefficient /°C 0°C – 18°C 28°C – 55°C
DC Voltage	100.0000 mV		0.0030 + 0.0030	0.0040 + 0.0035	0.0050 + 0.0035	0.0005 + 0.0005
	1.000000 V		0.0020 + 0.0006	0.0030 + 0.0007	0.0040 + 0.0007	0.0005 + 0.0001
	10.00000 V		0.0015 + 0.0004	0.0020 + 0.0005	0.0035 + 0.0005	0.0005 + 0.0001
	100.0000 V		0.0020 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0005 + 0.0001
	1000.000 V		0.0020 + 0.0006	0.0035 + 0.0010	0.0045 + 0.0010	0.0005 + 0.0001
Resistance [4]	100.0000 Ω	1 mA	0.0030 + 0.0030	0.008 + 0.004	0.010 + 0.004	0.0006 + 0.0005
	1.000000 kΩ	1 mA	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001
	10.00000 kΩ	100 μA	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001
	100.0000 kΩ	10 μA	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.0006 + 0.0001
	1.000000 MΩ	5 μA	0.002 + 0.001	0.008 + 0.001	0.010 + 0.001	0.0010 + 0.0002
	10.00000 MΩ	500 nA	0.015 + 0.001	0.020 + 0.001	0.040 + 0.001	0.0030 + 0.0004
	100.0000 MΩ	500 nA // 10 MΩ	0.300 + 0.010	0.800 + 0.010	0.800 + 0.010	0.1500 + 0.0002
DC Current	10.00000 mA	< 0.1 V	0.005 + 0.010	0.030 + 0.020	0.050 + 0.020	0.002 + 0.0020
	100.0000 mA	< 0.6 V	0.01 + 0.004	0.030 + 0.005	0.050 + 0.005	0.002 + 0.0005
	1.000000 A	< 1 V	0.05 + 0.006	0.080 + 0.010	0.100 + 0.010	0.005 + 0.0010
	3.000000 A	< 2 V	0.10 + 0.020	0.120 + 0.020	0.120 + 0.020	0.005 + 0.0020
Continuity	1000.0 Ω	1 mA	0.002 + 0.010	0.008 + 0.020	0.010 + 0.020	0.001 + 0.002
Diode Test	1.0000 V	1 mA	0.002 + 0.010	0.008 + 0.020	0.010 + 0.020	0.001 + 0.002
DC:DC Ratio	100 mV to 1000 V		(Input Accuracy) + (Reference Accuracy) Input Accuracy = accuracy specification for the HI-LO input signal. Reference Accuracy = accuracy specification for the HI-LO reference input signal.			

Transfer Accuracy (typical)

$$\frac{(\text{24 hour \% of range error})}{2}$$

Conditions:

- Within 10 minutes and ± 0.5°C.
- Within ±10% of initial value.
- Following a 2-hour warm-up.
- Fixed range between 10% and 100% of full scale.
- Using 6½ digit slow resolution (100 PLC).
- Measurements are made using accepted metrology practices.

Measuring Characteristics

DC Voltage

Measurement Method:	Continuously integrating, multi-slope III A/D converter.
A/D Linearity:	0.0002% of reading + 0.0001% of range
Input Resistance:	
0.1 V, 1 V, 10 V ranges	Selectable 10 M Ω or >10 G Ω [11]
100 V, 1000 V ranges	10 M Ω $\pm$ 1%
Input Bias Current:	< 30 pA at 25°C
Input Terminals:	Copper alloy
Input Protection:	1000 V on all ranges

Resistance

Measurement Method:	Selectable 4-wire or 2-wire ohms. Current source referenced to LO input.
Max. Lead Resistance: (4-wire ohms)	10% of range per lead for 100 Ω , 1 k Ω ranges. 1 k Ω per lead on all other ranges.
Input Protection:	1000 V on all ranges

DC Current

Shunt Resistor:	0.1 Ω for 1A, 3A. 5 Ω for 10 mA, 100 mA
Input Protection:	Externally accessible 3A, 250 V fuse Internal 7A, 250 V fuse

Continuity / Diode Test

Response Time:	300 samples/sec with audible tone
Continuity Threshold:	Adjustable from 1 Ω to 1000 Ω

DC:DC Ratio

Measurement Method:	Input HI-LO / Reference HI-LO
Input HI-LO	100 mV to 1000 V ranges
Reference HI-Input LO	100 mV to 10 V ranges (autoranged)
Input to Reference	Reference LO to Input LO voltage < 2 V Reference HI to Input LO voltage < 12V

Measurement Noise Rejection

60 Hz (50 Hz) [5]

DC CMRR	140 dB
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Integration Time

100 PLC / 1.67s (2s)
10 PLC / 167 ms (200 ms)
1 PLC / 16.7 ms (20 ms)
0.2 PLC / 3 ms (3 ms)
0.02 PLC / 400 μ s (400 μ s)

Normal Mode Rejection [6]

60 dB [7]
60 dB [7]
60 dB [7]
0 dB
0 dB

Operating Characteristics [8]

Function	Digits	Readings/s	Additional Noise Error
DCV, DCI, and Resistance	6½	0.6 (0.5)	0% of range
	6½	6 (5)	0% of range
	5½	60 (50)	0.001% of range
	5½	300	0.001% of range [10]
	4½	1000	0.01% of range [10]

System Speeds [9]

Function Change	26/sec
Range Change	50/sec
Autorange Time	<30 ms
ASCII readings to RS-232	55/sec
ASCII readings to HP-IB	1000/sec
Max. Internal Trigger Rate	1000/sec
Max. External Trigger Rate to Memory	1000/sec
Max. External Trigger Rate to HP-IB	900/sec

Autozero OFF Operation

Following instrument warm-up at calibration temperature $\pm$ 1°C and <10 minutes, add 0.0002% range additional error + 5 μ V.

Settling Considerations

Reading settling times are affected by source impedance, cable dielectric characteristics, and input signal changes.

Measurement Considerations

HP recommends the use of Teflon® or other high-impedance, low-dielectric absorption wire insulation for these measurements.

- [1] Specifications are for 1-hour warm-up at 6½ digits.
- [2] Relative to calibration standards.
- [3] 20% overrange on all ranges, except 1000 Vdc, 3 A range.
- [4] Specifications are for 4-wire ohms function, or 2-wire ohms using Math Null. Without Math Null, add 0.2 Ω additional error in 2-wire ohms function.
- [5] For 1 k Ω unbalance in LO lead.
- [6] For power-line frequency $\pm$ 0.1%.
- [7] For power-line frequency $\pm$ 1%, subtract 20 dB.
For $\pm$ 3%, subtract 30 dB.
- [8] Readings speeds for 60 Hz and (50 Hz) operation, Autozero Off.
- [9] Speeds are for 4½ digits, Delay 0, Autozero OFF, and Display OFF. Includes measurement and data transfer over HP-IB.
- [10] Add 20 μ V for dc volts, 4 μ A for dc current, or 20 m Ω for resistance.
- [11] For these ranges, inputs beyond $\pm$ 17V are clamped through 100 k Ω (typical).

■ AC Characteristics

Accuracy Specifications ± (% of reading + % of range) [1]

Function	Range [3]	Frequency	24 Hour [2] 23°C ± 1°C	90 Day 23°C ± 5°C	1 Year 23°C ± 5°C	Temperature Coefficient/°C 0°C – 18°C 28°C – 55°C
True RMS AC Voltage [4]	100.0000 mV	3 Hz – 5 Hz	1.00 + 0.03	1.00 + 0.04	1.00 + 0.04	0.100 + 0.004
		5 Hz – 10 Hz	0.35 + 0.03	0.35 + 0.04	0.35 + 0.04	0.035 + 0.004
		10 Hz – 20 kHz	0.04 + 0.03	0.05 + 0.04	0.06 + 0.04	0.005 + 0.004
		20 kHz – 50 kHz	0.10 + 0.05	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
		50 kHz – 100 kHz	0.55 + 0.08	0.60 + 0.08	0.60 + 0.08	0.060 + 0.008
		100 kHz – 300 kHz [6]	4.00 + 0.50	4.00 + 0.50	4.00 + 0.50	0.20 + 0.02
	1.000000 V to 750.000 V	3 Hz – 5 Hz	1.00 + 0.02	1.00 + 0.03	1.00 + 0.03	0.100 + 0.003
		5 Hz – 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
		10 Hz – 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
		20 kHz – 50 kHz	0.10 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
		50 kHz – 100 kHz [5]	0.55 + 0.08	0.60 + 0.08	0.60 + 0.08	0.060 + 0.008
		100 kHz – 300 kHz [6]	4.00 + 0.50	4.00 + 0.50	4.00 + 0.50	0.20 + 0.02
True RMS AC Current [4]	1.000000 A	3 Hz – 5 Hz	1.00 + 0.04	1.00 + 0.04	1.00 + 0.04	0.100 + 0.006
		5 Hz – 10 Hz	0.30 + 0.04	0.30 + 0.04	0.30 + 0.04	0.035 + 0.006
		10 Hz – 5 kHz	0.10 + 0.04	0.10 + 0.04	0.10 + 0.04	0.015 + 0.006
	3.00000 A	3 Hz – 5 Hz	1.10 + 0.06	1.10 + 0.06	1.10 + 0.06	0.100 + 0.006
		5 Hz – 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.035 + 0.006
		10 Hz – 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
Additional Low Frequency Errors (% of reading)				Additional Crest Factor Errors (non-sinewave) [7]		
	Frequency	Slow	AC Filter Medium	Fast	Crest Factor	Error (% of reading)
	10 Hz – 20 Hz	0	0.74	—	1 – 2	0.05%
	20 Hz – 40 Hz	0	0.22	—	2 – 3	0.15%
	40 Hz – 100 Hz	0	0.06	0.73	3 – 4	0.30%
	100 Hz – 200 Hz	0	0.01	0.22	4 – 5	0.40%
	200 Hz – 1 kHz	0	0	0.18		
	> 1 kHz	0	0	0		

Sinewave Transfer Accuracy (typical)

Frequency	Error (% of range)	Conditions:
10 Hz – 50 kHz	0.002%	- Sinewave input.
50 kHz – 300 kHz	0.005%	- Within 10 minutes and ± 0.5°C.
		- Within ±10% of initial voltage and ±1% of initial frequency.
		- Following a 2-hour warm-up.
		- Fixed range between 10% and 100% of full scale (and <120 V).
		- Using 6½ digit resolution.
		- Measurements are made using accepted metrology practices.

Measuring Characteristics

Measurement Noise Rejection [8]

AC CMRR 70 dB

True RMS AC Voltage

Measurement Method: AC-coupled True RMS – measures the ac component of input with up to 400 Vdc of bias on any range.
Crest Factor: Maximum 5:1 at full scale

AC Filter Bandwidth:

Slow 3 Hz – 300 kHz
Medium 20 Hz – 300 kHz
Fast 200 Hz – 300 kHz

Input Impedance: 1 M Ω $\pm$ 2%, in parallel with 100 pF

Input Protection: 750 V rms all ranges

True RMS AC Current

Measurement Method: Direct coupled to the fuse and shunt. AC-coupled True RMS measurement (measures the ac component only).

Shunt Resistor: 0.1 Ω for 1 A and 3 A ranges

Burden Voltage: 1 A range: < 1 V rms

3 A range: < 2 V rms

Input Protection: Externally accessible 3A, 250 V fuse
Internal 7A, 250 V fuse

Settling Considerations

Applying >300 V rms (or >1 A rms) will cause self-heating in signal-conditioning components. These errors are included in the instrument specifications. Internal temperature changes due to self-heating may cause additional error on lower ac voltage ranges. The additional error will be less than 0.02% of reading and will generally dissipate within a few minutes.

Operating Characteristics [9]

Function	Digits	Reading/s	AC Filter
ACV, ACI	6½	7 sec/reading	Slow
	6½	1	Medium
	6½	1.6 [10]	Fast
	6½	10	Fast
	6½	50 [11]	Fast

System Speeds [11] , [12]

Function or Range Change	5/sec
Autorange Time	<0.8 sec
ASCII readings to RS-232	50/sec
ASCII readings to HP-IB	50/sec
Max. Internal Trigger Rate	50/sec
Max. External Trigger Rate to Memory	50/sec
Max. External Trigger Rate to HP-IB/RS-232	50/sec

- [1] Specifications are for 1-hour warm-up at 6½ digits, Slow ac filter, sinewave input.
- [2] Relative to calibration standards.
- [3] 20% overrange on all ranges, except 750 Vac, 3 A range.
- [4] Specifications are for sinewave input >5% of range. For inputs from 1% to 5% of range and <50 kHz, add 0.1% of range additional error. For 50 kHz to 100 kHz, add 0.13% of range.
- [5] 750 Vac range limited to 100 kHz or 8x10⁷ Volt-Hz.
- [6] Typically 30% of reading error at 1 MHz.
- [7] For frequencies below 100 Hz, slow AC filter specified for sinewave input only.
- [8] For 1 k Ω unbalance in LO lead.
- [9] Maximum reading rates for 0.01% of ac step additional error. Additional settling delay required when input dc level varies.
- [10] For External Trigger or remote operation using default settling delay (Delay Auto).
- [11] Maximum useful limit with default settling delays defeated.
- [12] Speeds are for 4½ digits, Delay 0, Display OFF, and Fast AC filter.

■ Frequency and Period Characteristics

Accuracy Specifications ± (% of reading) [1]

Function	Range [3]	Frequency	24 Hour [2] 23°C ± 1°C	90 Day 23°C ± 5°C	1 Year 23°C ± 5°C	Temperature Coefficient/°C 0°C – 18°C 28°C – 55°C
Frequency, Period [4]	100 mV to 750 V	3 Hz – 5 Hz	0.10	0.10	0.10	0.005
		5 Hz – 10 Hz	0.05	0.05	0.05	0.005
		10 Hz – 40 Hz	0.03	0.03	0.03	0.001
		40 Hz – 300 kHz	0.006	0.01	0.01	0.001

Additional Low-Frequency Errors (% of reading) [4]

Frequency	Resolution		
	6 ¹ / ₂	5 ¹ / ₂	4 ¹ / ₂
3 Hz – 5 Hz	0	0.12	0.12
5 Hz – 10 Hz	0	0.17	0.17
10 Hz – 40 Hz	0	0.2	0.2
40 Hz – 100 Hz	0	0.06	0.21
100 Hz – 300 Hz	0	0.03	0.21
300 Hz – 1 kHz	0	0.01	0.07
> 1 kHz	0	0	0.02

Transfer Accuracy (typical)
0.0005% of reading

- Conditions:
- Within 10 minutes and ± 0.5°C.
 - Within ±10% of initial value.
 - Following a 2-hour warm-up.
 - For inputs > 1 kHz and > 100 mV.
 - Using 6¹/₂ digit slow resolution (1 second gate time).
 - Measurements are made using accepted metrology practices.

Measuring Characteristics

Frequency and Period

Measurement Method:	Reciprocal-counting technique. AC-coupled input using the ac voltage measurement function.
Voltage Ranges:	100 mV rms full scale to 750 V rms. Auto or manual ranging.
Gate Time:	10 ms, 100 ms, or 1 sec

Settling Considerations

Errors will occur when attempting to measure the frequency or period of an input following a dc offset voltage change. The input blocking RC time constant must be allowed to fully settle (up to 1 sec) before the most accurate measurements are possible.

Measurement Considerations

All frequency counters are susceptible to error when measuring low-voltage, low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors.

Operating Characteristics [5]

Function	Digits	Reading/s
Frequency,	6½	1
Period	5½	9.8
	4½	80

System Speeds [5]

Configuration Rates	14/sec
Autorange Time	<0.6 sec
ASCII readings to RS-232	55/sec
ASCII readings to HP-IB	80/sec
Max. Internal Trigger Rate	80/sec
Max. External Trigger Rate to Memory	80/sec
Max. External Trigger Rate to HP-IB/RS-232	80/sec

- [1] Specifications are for 1-hour warm-up at 6½ digits.
- [2] Relative to calibration standards.
- [3] 20% overrange on all ranges, except 750 Vac range.
- [4] Input > 100 mV.
For 10 mV input, multiply % of reading error x10.
- [5] Speeds are for 6½ digits, Delay 0, Display OFF, and Fast AC filter.

■ General Information

General Specifications

Power Supply:	100 V / 120 V / 220 V / 240 V ±10%.
Power Line Frequency:	45 Hz to 66 Hz and 360 Hz to 440 Hz. Automatically sensed at power-on.
Power Consumption:	25 VA peak (10 W average)
Operating Environment:	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40°C
Storage Environment:	-40°C to 70°C
Operating Altitude:	Up to 2,000 meters
Rack Dimensions (HxWxD):	88.5 mm x 212.6 mm x 348.3 mm
Weight:	3.6 kg (8 lbs)
Safety:	Designed to CSA 231, UL 1244, IEC 1010-1 (1990)
EMI: [1]	MIL-461C (data on file),   
Vibration and Shock:	MIL-T-28800E Type III, Class 5 (data on file)
Warranty:	3 years standard

Accessories Included

Test Lead Kit with probes, alligator, and grabber attachments.
User's Guide, Service Guide, test report, and power cord.

Triggering and Memory

Reading HOLD Sensitivity:	0.01%, 0.1%, 1%, or 10% of reading
Samples per Trigger:	1 to 50,000
Trigger Delay:	0 to 3600 sec (10 µs step size)
External Trigger Delay:	< 1 ms
External Trigger Jitter:	< 500 µs
Memory:	512 readings

Math Functions

Null, Min/Max/Average, dB, dBm, Limit Test (with TTL output).
dBm reference resistances: 50, 75, 93, 110, 124, 125, 135, 150,
250, 300, 500, **600**, 800, 900, 1000, 1200, or 8000 ohms.

Standard Programming Languages

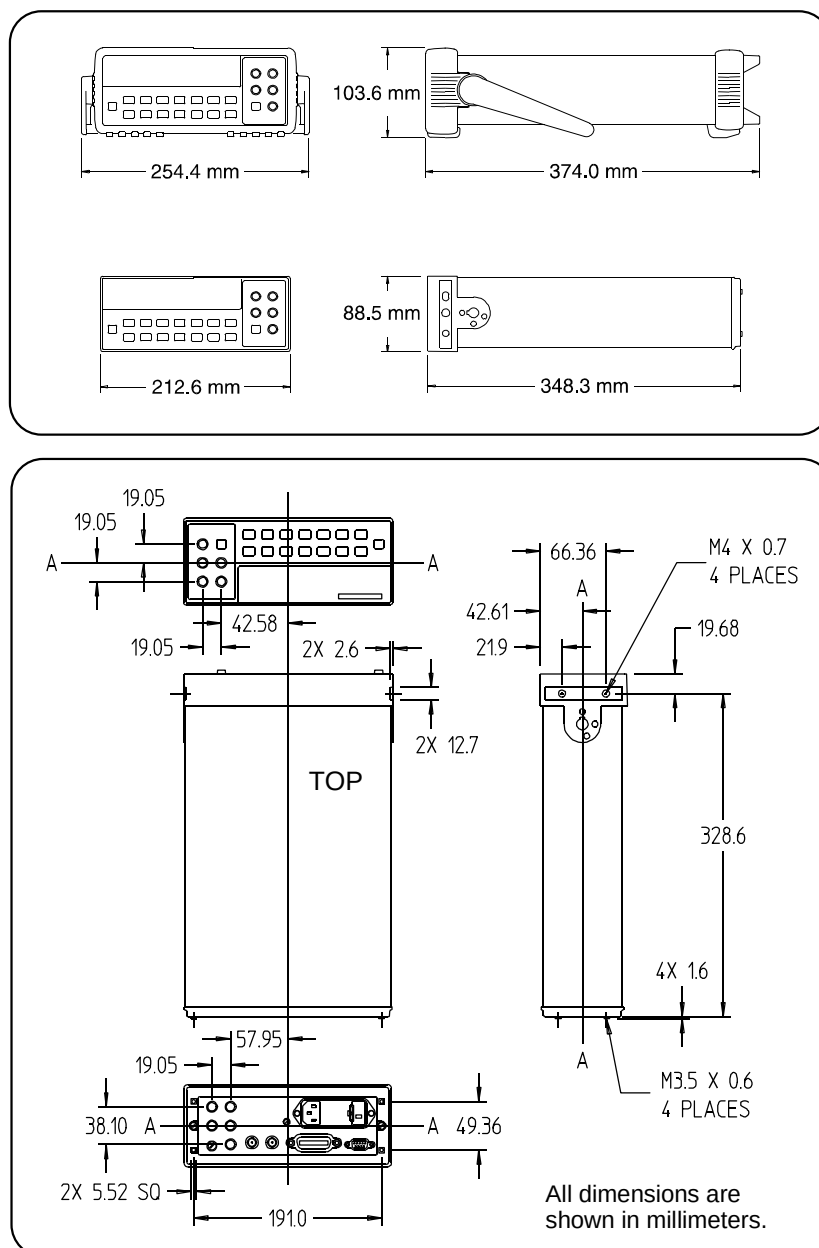
SCPI (*Standard Commands for Programmable Instruments*)
HP 3478A Language Emulation
Fluke 8840A, Fluke 8842A Language Emulation

Remote Interface

HP-IB (IEEE-488.1, IEEE-488.2) and RS-232C

[1] Slight accuracy degradation may result when subjected
to 3 V/m radiated fields.

■ Product Dimensions



To Calculate Total Measurement Error

Each specification includes correction factors which account for errors present due to operational limitations of the multimeter. This section explains these errors and shows how to apply them to your measurements. Refer to “Interpreting Multimeter Specifications,” starting on page 226, to get a better understanding of the terminology used and to help you interpret the multimeter’s specifications.

The multimeter’s accuracy specifications are expressed in the form: (*% of reading + % of range*). In addition to the reading error and range error, you may need to add additional errors for certain operating conditions. Check the list below to make sure you include *all* measurement errors for a given function. Also, make sure you apply the conditions as described in the footnotes on the specification pages.

- If you are operating the multimeter outside the $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ temperature range specified, apply an additional *temperature coefficient error*.
- For dc voltage, dc current, and resistance measurements, you may need to apply an additional *reading speed error* or *autozero OFF error*.
- For ac voltage and ac current measurements, you may need to apply an additional *low frequency error* or *crest factor error*.

Understanding the “% of reading” Error The *reading error* compensates for inaccuracies that result from the function and range you select, as well as the input signal level. The reading error varies according to the input level on the selected range. This error is expressed in percent of reading. The following table shows the reading error applied to the multimeter’s 24-hour dc voltage specification.

Range	Input Level	Reading Error (% of reading)	Reading Error Voltage
10 Vdc	10 Vdc	0.0015	$\leq 150\ \mu\text{V}$
10 Vdc	1 Vdc	0.0015	$\leq 15\ \mu\text{V}$
10 Vdc	0.1 Vdc	0.0015	$\leq 1.5\ \mu\text{V}$

Understanding the “% of range” Error The *range error* compensates for inaccuracies that result from the function and range you select. The range error contributes a constant error, expressed as a percent of range, *independent* of the input signal level. The following table shows the range error applied to the multimeter’s 24-hour dc voltage specification.

Range	Input Level	Range Error (% of range)	Range Error Voltage
10 Vdc	10 Vdc	0.0004	≤ 40 μV
10 Vdc	1 Vdc	0.0004	≤ 40 μV
10 Vdc	0.1 Vdc	0.0004	≤ 40 μV

Total Measurement Error To compute the total measurement error, add the reading error and range error. You can then convert the total measurement error to a “percent of input” error or a “ppm (part-per-million) of input” error as shown below.

$$\% \text{ of input error} = \frac{\text{Total Measurement Error}}{\text{Input Signal Level}} \times 100$$

$$\text{ppm of input error} = \frac{\text{Total Measurement Error}}{\text{Input Signal Level}} \times 1,000,000$$

Error Example

Assume that a 5 Vdc signal is input to the multimeter on the 10 Vdc range. Compute the total measurement error using the 90-day accuracy specifications: ±(0.0020% of reading + 0.0005% of range).

Reading Error

= 0.0020% × 5 Vdc

= 100 μV

Range Error

= 0.0005% × 10 Vdc

= 50 μV

Total Error

= 100 μV + 50 μV

= ± 150 μV

= ± 0.0030% of 5 Vdc

= ± 30 ppm of 5 Vdc

Interpreting Multimeter Specifications

This section is provided to give you a better understanding of the terminology used and will help you interpret the multimeter's specifications.

Number of Digits and Overrange

The “number of digits” specification is the most fundamental, and sometimes, the most confusing characteristic of a multimeter. The number of digits is equal to the maximum number of “9's” the multimeter can measure or display. This indicates the number of *full digits*. Most multimeters have the ability to overrange and add a partial or “½” digit.

For example, the HP 34401A can measure 9.99999 Vdc on the 10 V range. This represents six full digits of resolution. The multimeter can also overrange on the 10 V range and measure up to a maximum of 12.00000 Vdc. This corresponds to a 6½-digit measurement with 20% overrange capability.

Sensitivity

Sensitivity is the minimum level that the multimeter can detect for a given measurement. Sensitivity defines the ability of the multimeter to respond to small changes in the input level. For example, suppose you are monitoring a 1 mVdc signal and you want to adjust the level to within $\pm 1 \mu\text{V}$. To be able to respond to an adjustment this small, this measurement would require a multimeter with a sensitivity of at least $1 \mu\text{V}$. You could use a 6½-digit multimeter *if* it has a 1 Vdc or smaller range. You could also use a 4½-digit multimeter with a 10 mVdc range.

For ac voltage and ac current measurements, note that the smallest value that can be measured is different from the sensitivity. For the HP 34401A, these functions are specified to measure down to 1% of the selected range. For example, the multimeter can measure down to 1 mV on the 100 mV range.

Resolution

Resolution is the numeric ratio of the maximum displayed value divided by the minimum displayed value on a selected range. Resolution is often expressed in percent, parts-per-million (ppm), counts, or bits. For example, a 6½-digit multimeter with 20% overrange capability can display a measurement with up to 1,200,000 counts of resolution. This corresponds to about 0.0001% (1 ppm) of full scale, or 21 bits including the sign bit. All four specifications are equivalent.

Accuracy

Accuracy is a measure of the “exactness” to which the multimeter’s measurement uncertainty can be determined *relative to* the calibration reference used. Absolute accuracy includes the multimeter’s relative accuracy specification plus the known error of the calibration reference relative to national standards (such as the U.S. National Institute of Standards and Technology). To be meaningful, the accuracy specifications must be accompanied with the conditions under which they are valid. These conditions should include temperature, humidity, and time.

There is no standard convention among multimeter manufacturers for the confidence limits at which specifications are set. The table below shows the probability of non-conformance for *each specification* with the given assumptions.

Specification Criteria	Probability of Failure
Mean ± 2 sigma	4.5%
Mean ± 3 sigma	0.3%
Mean ± 4 sigma	0.006%

Variations in performance from reading to reading, and instrument to instrument, decrease for increasing number of sigma for a given specification. This means that you can achieve greater actual measurement precision for a specific accuracy specification number. The HP 34401A is designed and tested to meet performance better than mean ±4 sigma of the published accuracy specifications.

Transfer Accuracy

Transfer accuracy refers to the error introduced by the multimeter due to noise and short-term drift. This error becomes apparent when comparing two nearly-equal signals for the purpose of “transferring” the known accuracy of one device to the other.

24-Hour Accuracy

The 24-hour accuracy specification indicates the multimeter’s relative accuracy over its full measurement range for short time intervals and within a stable environment. Short-term accuracy is usually specified for a 24-hour period and for a $\pm 1^{\circ}\text{C}$ temperature range.

90-Day and 1-Year Accuracy

These long-term accuracy specifications are valid for a $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ temperature range. These specifications include the initial calibration errors plus the multimeter’s long-term drift errors.

Temperature Coefficients

Accuracy is usually specified for a $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ temperature range. This is a common temperature range for many operating environments. You must add additional temperature coefficient errors to the accuracy specification if you are operating the multimeter outside a $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ temperature range (the specification is per $^{\circ}\text{C}$).

Configuring for Highest Accuracy Measurements

The measurement configurations shown below assume that the multimeter is in its power-on or reset state. It is also assumed that manual ranging is enabled to ensure proper full scale range selection.

DC Voltage, DC Current, and Resistance Measurements:

- Set the resolution to 6 digits (you can use the 6 digits slow mode for further noise reduction).
- Set the input resistance to greater than 10 G Ω (for the 100 mV, 1 V, and 10 V ranges) for the best dc voltage accuracy.
- Use 4-wire ohms for the best resistance accuracy.
- Use Math Null to null the test lead resistance for 2-wire ohms, and to remove interconnection offset for dc voltage measurements.

AC Voltage and AC Current Measurements:

- Set the resolution to 6 digits.
- Select the slow ac filter (3 Hz to 300 kHz).

Frequency and Period Measurements:

- Set the resolution to 6 digits.